

SHORT COMMUNICATION

ISOLATION OF HIGH YIELDING MUTANTS IN MUNGBEAN (*VIGNA RADIATA* (L.) WILCZEK)

SAMIULLAH KHAN AND MOHD. RAFIQ WANI
Aligarh Muslim University, Aligarh – 202 002 (U.P.), India.

ABSTRACT

Some mutants of mungbean (*Vigna radiata* (L.) Wilczek) var. Pusa Baisakhi were evaluated to find out the selection response in M_3 generation. Increase in yield concurrent with the increase in mean values of fertile branches and pods/plant was noticed. Estimates of genetic variability for yield and yield components were higher. Correlation between various character pairs of the mutants showed positive and significant relationship with fertile branches, pods and seed yield/plant.

KEY WORDS: Chemical mutagens, High yielding mutants, Mungbean.

INTRODUCTION

A rational approach towards the improvement of any crop plant involves selection. A selection within the base population and utilization of the selected material would produce germplasm that will result in the desired ideotypes. Polygenic variation induced by mutagens could be fixed by selection in subsequent generations, and improvement of various desirable traits could be achieved in crop plants. Since mungbean is a self pollinated crop, mutation breeding is an important source for creating genetic variability.

MATERIALS AND METHODS

A field experiment was conducted during *kharif* seasons 2000/01, 2001/02 and 2002/03 at the Agricultural Farm, Aligarh Muslim University, Aligarh. Seeds of mungbean var. Pusa Baisakhi, presoaked in distilled water for 9h were treated with chemical mutagens, 0.1% and 0.2% EMS (ethylmethane sulphonate), 0.01% MMS (methylmethane sulphonate) and 0.01% SA (sodium azide) for 6h. Seeds soaked in distilled water were used as controls. Seeds harvested from individual M_1 plants were sown as M_2 families in three replications in the field. For raising M_3 generation, ten M_2 progenies which showed significant deviation in the positive direction from the mean values of control, particularly for yield and yield components were selected. Seeds from each selected M_2 progeny were bulked by taking an equal quantity of seeds from all M_2 plants of a single M_2 progeny and thoroughly mixed. A random sample of this bulk was sown to obtain M_3 progeny. ANOVA was performed to test the significance of variance. Heritability (h^2) in broad sense and phenotypic correlation among various character pairs were calculated using the formulae suggested by Singh and Chaudhary (1985) and genetic advance by the method outlined by Johnson *et al.* (1955).

MUTATION BREEDING OF MUNGBEAN

RESULTS AND DISCUSSION

On the basis of yield per plant, mutants which were superior were selected in M_2 and grown in progeny rows in M_3 generation to evaluate parameters such as fertile branches/plant, pods/plant and total plant yield. Data on genetic parameters of different mutants and parent in M_3 generation are presented in Tables 1 and 2. Yield per plant of mutants isolated in M_3 generation ranged from 12.50-14.81 g (Pusa Baisakhi-A), 12.21-13.00 g (Pusa Baisakhi-B), 12.80-14.50 g (Pusa Baisakhi-C) and 12.00-13.94 g (Pusa Baisakhi-D), while in the control it ranged from 9.24-10.21 g (Var. Pusa Baisakhi) per plant. Data indicate that mean values of fertile branches/plant, pods/plant and total plant yield increased significantly in different mutant lines in comparison to the control. The mutant Pusa Baisakhi-A (0.1% EMS) gave the highest mean plant yield of 13.87 g in M_3 generation as against the control, which gave a mean plant yield of 9.74 g. Selection for number of fertile branches, number of pods and seed yield/plant in M_3 generation was found to be effective in mutants as evident from the increased values of genotypic coefficient of variation, heritability and genetic advance, indicating that these characters can be transmitted to future generations and further improvement of these quantitative characters is possible in subsequent generations. Frey (1969) reported that mutagen derived variability for quantitative characters in crop plants is heritable and that the response to selection is good. Delayed selection is preferred as deleterious mutations are generally eliminated in early generations.

A significant increase in positive correlations between the fertile branches and pods, fertile branches and the total plant yield and pods and total plant yield were observed (Table 3). Pusa Baisakhi-D (0.01% SA) was exceptional as there was no significant correlation between fertile branches and total plant yield and between pods and total plant yield. A negative correlation between fertile branches and total plant yield in control population was changed to positive correlation by the mutagenic treatment in the mutant Pusa Baisakhi-D (Table 3). Khan *et al.* (1999) reported a negative correlation between the character pairs in the var. K-851 of mungbean which changed to positive correlation by treatment with alkylating agents. The degree of association of plant characters has always been helpful as a basis for selection. A number of significant changes towards the desirable side were induced in the correlation coefficient of various pairs in the mutants isolated in M_3 generation. The correlation between any two characters in an ordinary population should be the composite of the effect of selection, gene linkage and altered pleiotrophic effect of the newly mutated genes (Sakai and Suzuki, 1964; Sharma and Sharma, 1981; Khan, 1990).

CONCLUSION

The increased genetic variability in yield and yield components for these mutants provides scope for further selection. Thus, the induced variability can be effectively exploited for the improvement of mungbean.

REFERENCES

- Frey, K.J. 1969. Release of mutagen induced genetic variability in oats by outcrossing. Japan J. Genet. 44: 396-403.
- Johnson, H.W., H.F. Robinson and R.E. Comstock. 1955. Estimates of genetic and environmental variability in soybean. Agron. J. 47: 315-318.
- Khan, S. 1990. Studies on induced chemical mutagenesis in mungbean (*Vigna radiata* (L.) Wilczek). Ph.D. Thesis. Aligarh Muslim University, Aligarh.
- Khan, S., B.A. Siddiqui and M. Rehman. 1999. Mutation genetic studies in mungbean. III. Screening of high yielding mutants. J. Cytol. Genet. 34(1): 75-78.
- Sakai, K.I. and A. Suzuki. 1964. Induced mutations and pleiotropy of genes responsible for quantitative characters in rice. Rad. Bot. 4: 141-151.
- Sharma, S.K. and B. Sharma. 1981. Effect of mutagens on character association in lentil. Ind. J. Agric. Sci. 51(9): 619-622.
- Singh, R.K. and B.D. Chaudhary. 1985. Biometrical methods in quantitative genetic analysis. Kalyani 42p.

Table 1. Description of the mutants isolated in M_3 generation.

Strain	Treatment	Duration of Treatment	Remarks
<i>Pusa Baisakhi</i>	Control	-	-
1. <i>Pusa Baisakhi-A</i>	0.1% EMS	6 h	High yield
2. <i>Pusa Baisakhi -B</i>	0.2% EMS	6 h	High yield
3. <i>Pusa Baisakhi -C</i>	0.01% MMS	6 h	High yield
4. <i>Pusa Baisakhi -D</i>	0.01% SA	6 h	High yield

Table 2. Estimation of genetic parameters for quantitative characters of the mutants isolated in M_3 generation.

Strain	Treatment	Mean $\pm$ S.E.	Range	Shift in $\bar{x}$	CV _p (%)	CV _g	h ² (%)	Gs(% of) $\bar{x}$
Fertile branches/plant								
Pusa Baisakhi	PB (control)	6.25 $\pm$ 0.21	5-7	0.00	16.57	9.24	31.06	13.58
1. Pusa Baisakhi-A	0.1% EMS	11.58 $\pm$ 0.33	10-14	+5.33	23.79	19.24	65.39	41.07
2. Pusa Baisakhi-B	0.2% EMS	9.83 $\pm$ 0.20	9-11	+3.58	17.59	13.47	58.64	27.23
3. Pusa Baisakhi-C	0.01% MMS	11.75 $\pm$ 0.47	9-14	+5.50	28.01	26.40	88.83	65.68
4. Pusa Baisakhi-D	0.01% SA	10.66 $\pm$ 0.28	9-11	+4.41	25.31	21.56	72.56	48.48
CD (p = 0.01)				1.40				
Pods / plant								
Pusa Baisakhi	PB (control)	47.50 $\pm$ 0.39	45-50	0.00	12.11	7.30	36.33	11.16
1. Pusa Baisakhi-A	0.1% EMS	87.16 $\pm$ 1.40	83-96	+39.66	17.20	14.34	69.50	31.56
2. Pusa Baisakhi-B	0.2% EMS	68.25 $\pm$ 0.79	64-72	+20.75	15.64	12.23	61.14	25.24
3. Pusa Baisakhi-C	0.01% MMS	83.41 $\pm$ 0.86	78-80	+35.91	15.37	12.14	62.38	25.31
4. Pusa Baisakhi-D	0.01% SA	75.08 $\pm$ 0.82	70-80	+27.58	14.36	11.14	60.18	22.81
CD (p = 0.01)				4.40				
Total plant yield (g)								
Pusa Baisakhi	PB (control)	9.74 $\pm$ 0.09	9.24-10.21	0.00	9.12	4.37	22.94	5.52
1. Pusa Baisakhi-A	0.1% EMS	13.87 $\pm$ 0.19	12.50-14.81	+4.13	22.04	17.89	65.89	38.33
2. Pusa Baisakhi-B	0.2% EMS	12.70 $\pm$ 0.07	12.21-13.00	+2.96	21.44	16.21	57.16	32.35
3. Pusa Baisakhi-C	0.01% MMS	13.79 $\pm$ 0.13	12.80-14.50	+4.05	19.40	16.13	69.12	35.40
4. Pusa Baisakhi-D	0.01% SA	12.62 $\pm$ 0.17	12.00-13.94	+2.88	17.35	14.21	67.06	30.71
CD (p = 0.01)					0.81			

PB – Pusa Baisakhi, $\pm$ S.E. – Standard error; CV_p – Phenotypic coefficient of variation; CV_g – Genotypic coefficient of variation

Table 3. Phenotypic correlation between different character pairs.

Strain	Treatment	Fertile branches/plant vs. Pods/plant	Fertile branches/plant vs. Total plant yield (g)	Pods/plant vs. Total plant yield (g)
Pusa Baisakhi	Pusa Baisakhi (control)	0.866	-0.079	0.260
1. Pusa Baisakhi-A	0.1% EMS	0.913*	0.980**	0.902*
2. Pusa Baisakhi-B	0.2% EMS	0.907*	0.938*	0.996**
3. Pusa Baisakhi-C	0.01% MMS	0.983**	0.999**	0.984**
4. Pusa Baisakhi-D	0.01% SA	0.979**	0.609	0.436

* Significant at 5% level

** Significant at 1% level